An Address
ON
THE HISTORICAL RELATIONS BETWEEN SURGERY AND MEDICINE.

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[Abstract.]

[After recalling the way in which about the year 1864 surgeons began to treat such cases as abdominal tumours, ileus, and other abdominal conditions and cerebral tumour which had previously been considered to belong to the province of physic, Professor Clifford Allbutt continued:]

It seems to me that the present is a critical moment in the relations of medicine and surgery, especially in England, where the two branches of the art have been separated so radically as to appear to be "two professions"—a moment when it is our duty to contemplate the unity of medicine, to forecast its developments as a connected whole, and to conceive a rational ideal of its means and ends. But this large and prophetic vision of medicine we cannot attain without a thoughtful study of its past. If, as from a height, we contemplate the story of the world, not its pageants, for in their splendour our eyes are dim, but the gathering, propagation, and ordination of its forces, whence they sprang and how they blend this way and that to build the ideas and institutions of men, we may wonder at their creative activity or weep over the errors and the failures, the spoliation and the decay, which have marred or thwarted them; and if we contemplate not the whole but some part of men's sowing and men's harvest, such a part as medicine, the keener is our sorrow and disappointment, or our joy and our hope, as we admire the great ends we have gained or dwell upon the loss and suffering which have darkened the way. In the development of medicine, said Helmholtz, "there lies a great lesson on the true principles of scientific progress."

Pray do not fear, however, that to fulfil the meaning of the title of this address I shall describe to you the history of medicine and the history of surgery, and on this double line compare and combine my researches; in the time allotted to me no such survey is possible. In the seventeenth century the handicrafts of anatomy, chemistry, and physiology so penetrated medicine that the separate influence of surgery is less easily discernible. My purpose, therefore, is to pass in review certain eminent features of the history of these departments of knowledge up to the end of the sixteenth century and to compare them with a view to edification; your fear will be rather that I may tell my story with the unrighteousness of a man with a moral. In his address on Morgagni at Rome in 1894 Virchow said that medicine is remarkable in its unbroken development for twenty-five centuries—as we may say without irreverence, from Hippocrates to Virchow himself. The great pathologist's opinion, however, seems to need severe qualification; if it be so, the stream has more than once flowed long underground. The discontinuity of medicine from Egypt to Crotona and Ionia is scarcely greater than from Galen to Avicenna, during which period, in spite of a few eminent teachers in the Byzantine Empire, it sank—in the West at any rate—into a sterile, foul, and superstitious routine.

[After referring to Hippocrates, who was "in genius perhaps the greatest physician of all past time," Professor Clifford Allbutt proceeded:]

The chief lesson of the Hippocratic period for us is that, in practice as in honour, medicine and surgery were then one; the Greek physician had no more scruple in using his hands in the service of his brains than had Pheidias or Archimedes; and it was by this co-operation in the fifth century that the advance was achieved which in our eyes is marvellous. As we pursue the history of medicine in later times we shall see the error, the blindness, and the vanity of physicians who neglected and despised a noble handicraft. The clear eyes of the ancient Greeks perceived that an art is not liberal or illiberal by its manipulations, but by its ends.

Between Hippocrates and Galen, an interval of some five centuries, flourished the great anatomical and medical schools of Alexandria. Our only important source, however, for the medicine of the Alexandrian period is Celsus, who lived in the reign of Augustus. In Celsus we find that the surgical and the obstetrical sides of it had made further substantial progress. Besides the Hippocratic surgery we recognize means of treatment in piles, fistula, rodent ulcer, eczema, fractures, and luxations; the nasal passages were cauterized for ozaena, dropsies were systematically tapped, hernias were submitted to radical cure, plastic operations were undertaken, and for the first time the larger limbs were deliberately amputated, though only in extreme need and often with fatal results by secondary haemorrhage and otherwise. How active surgery was from Celsus to Galen and how honourable and intimate a part of medicine we know from the scanty records of Archigenes of Apamea, who also practised in Rome in the reign of Trajan. Galen calls him an acute but too subtle a physician. Such of his subtleties, however, as are known to us—his distinction between primary and consequential symptoms, for instance—are to his credit. He applied the ligature in amputations and Antyllus applied the method to the cure of aneurysm, which, indeed, Rufus seems to have done before him. Galen tells us where he got his "Celtic linen thread" for the purpose—namely, "at a shop in the Via Sacra between the Temple of Rome and the Forum." We learn also from Oribasius that Antyllus practised extensive resections of bone in the limbs and even in the upper and lower jaw. Galen came to Rome under Marcus Aurelius. In the biological sciences this great physician stands to Harvey as in physics Archimedes stood to Galileo and to that other great physician, William Gilbert. Galen was the first, as for many centuries he was the last, to apply the experimental method to physiology. He embraced the ancillary sciences, he opened out new routes, and he improved the old. Unhappily, his soaring genius took delight also in speculation, and it was not the breadth of his science nor the depth of his methodical experiment but the height of his visionary conceits which imposed upon the Middle Ages. Galen did not himself forget the precept of Hippocrates—to look, to touch, to hear (κάι ἰδεῖν, και θιγεῖν, και ἀκοῦσαι); but he did not wholly subdue himself—the πεῖρα τριβική—to this toilsome conversation with troublesome facts. Galen did not make any great mark on surgery; his tracts on the eye are lost, but, so far as we know, his surgery was adopted in the main from the Alexandrians and from Soranus. However, Galen successfully resected the sternum for caries, exposing the heart, and he excised a splintered shoulder-blade; moreover, with all his bent to speculative reason, we have no hint that he fell into the mediaeval abyss of regarding surgery as unfit for a scholar and gentleman.* After Galen and Soranus medicine came to the evening of its second day, to the long night before the rise of the Arabian, Italian, and French surgeons of the twelfth, thirteenth, and fourteenth centuries.

[After showing how by the twelfth century the wholesome discipline of practical surgery fell off and the tradition of Galen made for a plague of drugs, "which were least mischievous when merely superfluous," Professor Clifford Allbutt proceeded:]

Surgery saw its revenge, its bitter revenge, but in the ruin of its temple. In the thirteenth and fourteenth centuries surgery, hated and avoided by medical faculties, scorned in clerical and feudal circles, began in the hands of lowly and unlettered men to grow from a vigorous root, while inward medicine, withdrawing itself more and more from the laboratory of Nature, hardened into the shell, which till the seventeenth century was but a counterfeit. The surgeons of the thirteenth, fourteenth, and fifteenth centuries, reared in humble apprenticeships, not illiterate only but forbidden the very means of learning, lay under heavy disadvantages; yet such is the virtue of practical experience and technical resource, that by them the reform of medicine was made. Towards the end of the fifteenth century, indeed, even this progress had slackened, soon to be reinforced, however, by new and urgent problems, not of the schools, but of direct rough and tumble with Nature. Of these new problems, of which Paré became the chief interpreter, syphilis and the wounds of firearms were the chief.

[Professor Clifford Allbutt referred to Italy as leading the world in medicine from the twelfth to the eighteenth century.

* "Lords, indeed!" said Mr. Osbourne, "I saw one o' 'em speaking to a dam fidler, a fellar I despise."

Roger, who wrote the *Practica Chirurgiae* in 1180, used styptics, the suture, and the ligature. In his treatment of wounds he encouraged suppuration, and dressed them with ointments on lint. Professor Allbutt continued:]

Hugh of Lucca was born of honourable family about the middle of the twelfth century; he served as surgeon in campaigns, and was present at the siege of Damietta, but of writing he left not a line. Such vision as we have of him we owe to his loyal disciple, probably his son, the Dominican Theodoric, Bishop of Cervia, and master of Henry of Mondeville. He completed his *Surgery* in 1266, but his life was almost conterminous with the thirteenth century. What was Theodoric's message? He wrote thus:

For it is not necessary, as Roger and Roland have written, as many of their disciples teach, and as all modern surgeons profess, that pus should be generated in wounds. No error can be greater than this. Such a practice is, indeed, to hinder Nature, to prolong the disease, and to prevent the conglutination and consolidation of the wound.

In principle what more did Lister say than this? Henry of Mondeville made a hard fight for the new principle, but the champions of Galen and suppuration won all along the line, and for five following centuries to come poultices and grease were still to be applied to fresh wounds, and tents, plastered with irritants to promote suppuration, were still to be thrust into the recesses of them, even when there was no foreign body to be discharged. If after all this erysipelas set in—well, says Henry, lay it at the door of St. Eligius!

Hugh and Theodoric for the fresh wound rejected oil as too slippery for union and poultices as too moist; they washed the wound with wine, scrupulously removing every foreign particle; then they brought the edges together, forbidding wine or anything else to remain within. Dry and adhesive surfaces were their desire. Nature, they said, produces the means of union in a viscous exudation, or natural balm, as it was afterwards called by Paracelsus, Paré, and Würtz. In older wounds they did their best to obtain union by cleansing, desiccation, and refreshing of the edges. Upon the outer surface they laid only lint steeped in wine. Powders they regarded as too desiccating, for powder shuts in decomposing matters; wine, after washing, purifying, and drying the raw surfaces, evaporates. The quick, shrewd, and rational observation and the independent spirit of Theodoric I would gladly illustrate further did time permit. In passing, I may say that he was the first to notice salivation as the result of administration of mercury in "skin diseases."

Both for his own merits and as the master of Lanfranc, William Salicet was eminent among the great Italian physicians of the latter half of the thirteenth century. Distinguished in surgery, both as practitioner and author, he was also one of the protestants of the period against the division of the craft from inner medicine—a division which he justly regarded as a withdrawal of medicine from its intimacy with Nature. Like Lanfranc and all the great surgeons of the Italian tradition, and unlike Franco and Paré, he had the advantage of the liberal university education of Italy, but, like Paré and Würtz, he had large practical experience in camp, hospital, and prison. His surgery contains many case histories. He discovered that dropsy may be due to a "durities renum"; he substituted the knife for the abuse of the cautery by the followers of the Arabs; he pursued the investigation of the causes of the failure of healing by first intention; he described the danger of wounds of the neck; he forwarded the diagnosis of suppurative disease of the hip; and he referred chancre and gangrene to "coitus cum meretrice." The *Chirurgia Magna* of Lanfranc of Milan and Paris, published in 1295-6, was a great work written by a reverent but independent follower of Salicet. He distinguished between venous and arterial haemorrhage, and generally used styptics (rabbit's fur, aloes, and white of egg was a popular styptic in elder surgery), though in severe cases ligature. Learned man as he was, Lanfranc saw the more clearly the danger of separating surgery from medicine. "Good God!" he exclaims, "why this abandoning of operations by physicians to lay persons, disdaining surgery, as I perceive, because they do not know how to operate . . . an abuse which has reached such a point that the vulgar begin to think the same man cannot know medicine and surgery . . . say, however, that no man can be a good physician who has no knowledge of operative surgery; a knowledge of both branches is essential" (*Chir. Magna*).

Henry of Mondeville, of whom we hear first in 1301 as surgeon to Philip the Fair, was for the most part a loyal disciple of Lanfranc, and, aided as it would seem by Jean Pitard, also surgeon to the King, attempted for wounds to introduce the new methods of Hugh and Theodoric; for his pains he exposed himself to bad language, threats, and perils, and, "had it not been for truth and Charles of Valois," to far worse things. So he warns the young and poor surgeon not to plough the sand, but to prefer complaisance to truth and ease to new ideas. I may summarize briefly the teaching of Henry on the cardinal features of the new method: Wash the wound scrupulously from all foreign matter; use no probes, no tents—except in special circumstances; no oily or irritant applications; avoid the formation of pus, which is not a stage of healing, but a complication; do not, as Galen teaches, allow the wound to bleed with the notion of preventing inflammation, for you will only weaken the patient's vitality (virtus), give him two diseases instead of one, and foster secondary haemorrhage; distinguish between oozing haemorrhage, haemorrhage by jets, and that which pumps out of an inward wound, using for the first styptics and for the last two the cautery, or, where practicable, digital compression for not less than a full hour; when your dressings have been carefully made do not interfere with them for some days; keep the air out, for a wound left in contact with the air suppurates; however, should pain and heat arise, open and wash out again, or even a poultice may be necessary, but do not pull your dressings about. Nature works better alone; if first intention fail she may succeed in the second; as a jeweller, if he can solder gold to gold does so, if not, he has to take to borax; these resources, however, we learn well, not by arguing, but by operating. By the new method you will have no stinks, shorter convalescence, and clean, thin scars. When using the word "Nature" he freely admits that the word is an equivocal one, but he would speak of her allegorically as a lute player to whose melodies the physician has to dance.

Every simple wound will heal without any notable quantity of pus, if treated on Theodoric's and my instructions. Avoid every cause of formation of pus, such as irritating applications, exposure, high diet, oedema, local plethora. Many more surgeons know how to cause suppuration than how to heal a wound.

Now let me remind you that until Hugh of Lucca the universal doctrine was that suppuration or coction is necessary, and that if it does not set in it must be provoked.

The greatest of the French surgeons before Paré was Guy of Chauliac, who flourished in the second half of the fourteenth century. He studied in letters and medicine at Toulouse and Montpellier, in anatomy at Bologna. The surgeon ignorant of anatomy, he says, "carves the human body as a blind man carves wood." The Arabs and Paris said: Why dissect if you trust Galen? But the Italian physicians insisted on verification. Guy was called to Avignon by Clement VI. During the plague of 1348 he stayed to minister to the victims, and did not himself escape an attack, in which he was ill for six weeks. His description of this epidemic is terrible in its naked simplicity. He gave succour also in the visitation of 1360. His *Chirurgia Magna* I have studied carefully, and do not wonder that Fallopius compared the author to Hippocrates and that John Freind calls him the prince of surgeons. The work is rich, aphoristic, orderly, and precise. Guy was a more adventurous surgeon than Lanfranc, as was Franco, a later Provençal, than Paré. He did not cut for stone, but he operated for radical cure of hernia and for cataract—operations till his time left wholly to the wayfaring specialists. In Guy the critical spirit was awake. He scorns the physicians of his day, "who followed each other like cranes, whether for love or fear he would not say." In respect of principles, however, Guy was not infallible. Too sedulous a disciple of Galen, he was as a deaf adder to the new message of Hugh, Theodoric, and Henry, and not only was he deaf himself but, as the authoritative master of the early renascence, he closed the ears of his brethren even to the day of Lister.

In the midst of the mainly Arabist professors of medicine of the fifteenth century arose Benivieni, the forerunner of Morgagni and one of the greatest physicians of the late Middle Ages. This distinguished man, who was born in 1448 and died in 1502, was not a professor but a doctor of medicine, a man of culture and an eminent practitioner in Florence. Although born in the new platonism he was, like Mondeville, one of those fresh and independent observers who surrender to no authority, to Arab nor Greek. Yet for us Benivieni's fame is far more than all this, for he was the founder of the craft of pathological anatomy. So far as I know he was the first to make the custom and to declare the need of necropsy to reveal what he called not exactly "the secret causes" but the hidden causes of diseases. Before

Vesalius, Eustachius, or Fallopius were born, deliberately and clear-sightedly he opened the bodies of the dead as keenly as any pathologist in the spacious times of Morgagni, Haller, or Senac, or of Hunter, Baillie, and Bright. Among his pathological reports are morbus coxae (two cases), biliary calculus (two cases), abscess of the mesentery, thrombosis of the mesenteric vessels, stenosis of the intestine, "polypus" of the heart, scirrhus of the pylorus, and ruptured bowel (two cases). He gives a good description of senile gangrene.

It would be unjust to forget that in the latter half of the fifteenth century Paris admitted some reforms; celibacy for physicians was abolished and with it diminished the allurements of prebends and rectories and the pernicious practice of the "médecins reclus," who did not visit patients nor even see them, but received visits from ambassadors who brought gifts and vessels of urine and carried back answers far more presumptuous than that wise counsel of Falstaff's physician. Still, not only was reform in Paris very grudging but it was capriciously favoured and thwarted by the French Court. The Faculty denied to St. Côme "esoteric" teaching, diagnosis, and the use of medical therapeutics—a jealousy which ended in the physician being requested to do little more than write the prescription. Aristotle was quoted as unfavourable to the "vulgarizing of science." Joubert was attacked for editing Guy in the vernacular. Fortunately, the surgeons were carried into the field of battle—a far better school than the Paris Faculty. Thus it was that in the opening of that great century in the history of the human mind—the sixteenth century—we find Italian medicine still in the van until the birth of the great French surgeons, Franco and Paré, and of Gersdorff and Würtz of Germany.

Franco, like Paré, was no clerk; he came of a class lower even than that of Paré and the barbers—the wayfaring class of bonesetters, oculists, plastic operators, and cutters for stone and hernia. These dangerous ventral operations and those on the eye, which but too often were swiftly disastrous, fell into the hands of wandering craftsmen, men usually of low origin, ignorant, reckless, and rapacious. As the truss was a very clumsy instrument—at any rate, till the end of the seventeenth century—the radical cure of hernia was in great demand. It is not the least of the merits of Franco that he brought these operations within the lines of responsible surgery, and thrust them into the ken of Paré and Fabricius. This illustrious provincial surgeon—"*ce beau génie chirurgical*," as Malgaigne calls him, in declining the task of entering upon so full a life—was born about 1503. He began as an apprentice to an operating barber and to a hernia specialist. He had no more "education" than Paré or Würtz, and he was spared the misfortune of a speculative intellect. He picked up some anatomy, educated himself by observation, experience, and manipulation, and as a simple operator or "master" won considerable renown. As upright and modest as Paré, though he never attained Paré's high social position, he submitted to call in the physician, and took his quiet revenge in the remark that the physicians did not know enough to distinguish good surgery from bad. Nicaise says roundly: "No surgeon made such discoveries as Franco." For hernia, stone, and cataract he did much more than Paré. Whether from incapacity or the brutality of habit, it had been the custom during the Middle Ages and down even till the middle of the seventeenth century, in operating for hernia, to sacrifice one or even both testicles—an abuse against which Franco took successful precautions, for he proved that the canal could be closed and the ring sutured without castration. In irreducible inguinal hernia he distinguishes between opening and not opening the sac, and describes adhesions of sac and intestine. From him, indeed, dates the rational operation for strangulated hernia, and in strangulated scrotal hernia he founded the method. Paré and, after him, Petit condemned the ablation of the testicle, which procedure, however, many surgeons thought quite good enough for priests, and Paré gives credit to Franco for these advances, though Fabricius does not even mention them.

The very eminence of Ambroise Paré encourages, if it does not command, me to be content with a few words of commemoration. Himself of humble origin, he won for surgery in France a social place and respect it had never attained before. Born in 1517, he became a barber's apprentice in the Hôtel Dieu, whence he followed the campaign of Francis I. against Charles V. As he could not write a Latin treatise his admission to St. Côme was, of course, opposed by the Faculty, but Paré stoutly declared that the vernacular tongue was essential to the progress of medicine. Riolan the elder, who had taken part in the opposition, wrote a tract on the other side in 1577 with the following insolent title: "Ad impudentiam quorundam Chirurgorum qui medicis aequari et chirurgiam publicè profiteri volunt pro dignitate veteri medicinae apologia philosophica." Now, at this time Paré was 60 years of age and surgeon to the King. If, in comparison with Paré, Haeser treats Franco somewhat slightly, and if in some respects Paré may not be lifted far above his great Italian contemporaries, such as Maggi, Carpi, or Botallo, yet, taken all round, the founder of modern surgery surely surpasses all the physicians of his time as an independent, original, and inventive genius, and as a gentle, masterly, and true man.

Yet I am often surprised to see, even to-day, the invention of ligature of arteries attributed to Paré, whose surprise, if our journals have an astral shape, must be greater still, seeing that he himself refers the ligature to Galen. The attribution is, of course, a legend. Malgaigne discreetly claims no more for Paré than the application of the ligature from wound surgery to amputations, but, in my opinion, even this claim goes beyond the truth of history. Celsus speaks of the ligature as an ordinary method in wounds; from Oribasius we learn that Archigenes of Apamea even tied vessels in amputation after fixing a tight band at the root of the limb. It seems, probable, indeed, that unless the application of a ligature were performed with modern nicety secondary haemorrhage must have been frequent; indeed, in 1773 Petit deliberately discarded the ligature, as Franco and Fabricius had done before him. Military surgeons considered even Paré's "ligature en masse" as too delicate a method for the battlefield. It is a more intelligent service to a great man to point out that the ligature and other operative details were no mere incidents, but steps in a large reform of method in amputation—a reform made imperative by the ravages of firearms, which could not be covered up with galenisms.

To turn to Germany: Paracelsus (born 1491) was a surgeon and no inconsiderable one. Had this extraordinary man been endowed with a little patience he would have been a leader in wound surgery, though, like Würtz, he was not an operator. He pointed out not only the abuse of the suture by the surgeons of the day, but also that suppuration is bad healing, for, if left to herself, Nature heals wounds by a "natural balm"—a phrase which Paré adopted. In his *Grosse Wündarznei* he says he began at the surgical because it is the most certain part of medicine, and time after time he rebukes those who withdraw medicine from surgery. Brunschwig was the first surgeon to write upon the surgery of gunshot wounds with any fullness or precision. He held, as Vigo after him, that a gunshot wound was a poisoned wound, and, to eliminate the poison by free suppuration, used the medicated tents, or, in case of through penetration, the setons which were to arouse the angry antagonism of Würtz. Felix Würtz, like Franco and Paré, had the good fortune to escape a scholastic education; he was lucky enough, however, to enjoy the liberal education of Gesner's friendship and to listen to the fiery disputes of Paracelsus. Gifted with an independent and penetrating mind, he is as fresh and racy as Henry of Mondeville had genius enough to be in spite of the schools. Like all his compatriots, he wrote in the vernacular, and for its originality and conciseness Würtz's *Practica*, published in 1563, stands in a very small company. Had he known as much anatomy as Paré—his defect in which he bewails—he might have been as great a man, for his clinical advances were both new and important. He protests against the kind of examinations for practice held in some cities where candidates patter off cut-and-dried phrases like parrots, while apprentices "play upon the old fiddle the old tune continually." By setting his face against cataplasms and grease he made for progress, though neither he nor Paré attacked suppuration in principle as Theodoric and Henry had done. His chief title to fame—a fame far less ripe, of course, than that of Sydenham, but, as it seems to me, not unworthy to be remembered beside it—lies in his clinical acumen, and especially in his conception of wound infections and their results. His description of diphtheria is especially remarkable.

England—if by England we mean no more than the Isles of Britain—makes no great show in mediæval or renascence surgery. Arderne was probably a far better surgeon than Gilbert, or John of Gaddesden, but he is little more than a name. Nor does it do to peruse Thomas Gale (1507-1586?) after Mondeville, Guy, Paré, Würtz, or Maggi. Gale's merit lies mainly in the chapter on the Wounds made by Gonneshot in the third part of his *Surgery*, as he also withstood

"the gross error of Jerome Brunswicke and John of Vigo, that they make the wound venomous."

With the sixteenth century my survey must end. From this time medicine entered upon a new life, upon a new surgery founded on a new anatomy and on a new physiology of the circulation of the blood and lymph. These sciences, thus renewed, not only served surgery directly, but by the pervading influence of the new accuracy of observation also indirectly modified the traditional doctrines of physicians unversed in methods of research, as we observe in the objective clinical medicine of Sydenham. Our physiologists tell us that destruction is easy, construction difficult; but in the history of medical dogma this truth finds little illustration. So impatient is the speculative intellect of the yoke of inductive research, so tenacious is it of its castles in the air, that no sooner did Harvey, by revealing the mechanics of the circulation, sap the doctrines of the schools, than some physicians instantly set to work to run up the scheme of iatro-physics, others to build a system of iatro-chemics, but upon Von Helmont rather than on Willis and Mayow, while Hoffmann and his school resuscitated the *strictum* and *laxum* syllogisms of the Greek methodists.

In this sketch of the past—a sketch necessarily indiscriminate but not, I trust, indiscreet—we have seen that up to the time of Avicenna medicine was one and undivided; that surgery was regarded truly not as a department of disease but as an alternative treatment of any disease which the physician could reach with his hands; that the cleavage of medicine, not by some natural and essential division but by paltering to false pride and conceit, let the blood run out of both its moieties; that certain diseases thus cut adrift, being nourished only on the wind, dried into mummy or wasted in an atrophy, and that such was medicine; while the diseases which were on the side of the roots, if they lost something of their upper sap, were fed from below, and that such was surgery. Thus the physicians who were cut off from the life-giving earth, being filled with husks and dust, became themselves stark and fantastic. Broadly speaking, until the seventeenth century pathology was a factitious schedule and medicine a farrago of receipts, most of them nauseous, many of them filthy, most of them directly mischievous, all of them indirectly mischievous as tokens of a false notion of therapy. This is the truth I have tried to get home to you: that in the truncation of medicine the physician lost not only nor chiefly a potent means of treatment; he lost thereby a method; he lost touch with things, he deprived his brains of the co-operation of the subtlest machine in the world—the human hand—a machine which does far more than manufacture, which returns its benefits on the maker with usury, blessing both him that takes and him that gives. Pure thought, for its own sake, especially in early life, when the temptation to it is strong and experience small, seems so disinterested, so aloof from temptation of gain, that in the history of ideas speculation and the construction of speculative systems have played but too great a part and have occupied but too many minds of eminent capacity.

In the minds of academical teachers the notion still survives that the theoretical or university form and the practical or technical form of a profession or trade may not only be regarded separately and taught in some distinction—which may be true—but in independence of each other; nay, that the intrusion of the technical quality by materializing degrades the purity or liberality of the theoretical—that, indeed, if he had not to get his daily bread the high-minded student may do well to let the shop severely alone. Thus the university is prone to make of education thought without hands; the technical school hands without thought; each fighting shy of the other. But if in a liberal training the sciences must be taught whereby the crafts are interpreted, economised, and developed, no less do the crafts, by finding ever-new problems and tests for the sciences, inseminate and inform the sciences, as in our day physics are fertilized by the fine craft of such men as Helmholtz, Stokes, Rayleigh, and Kelvin, and biology by Virchow, Pasteur, and Lister.

If it be true, as I have been told, that the University of Birmingham has a coal mine upon the premises, I am ready to believe that the craft of coal-getting by carrying practice into thought will fortify the web of theory. There exists no doubt the contrary danger of reducing education to the narrow ideas and stationary habits of the mere artisan. By stereotyped methods the shop master who does not see beyond his nose may cramp the 'prentice and the 'prentice becomes shopmaster in his turn. We need the elevation, the breadth, the imagination which universities create and foster; but in universities we need also bridges in every parish between the provinces of craft and thought. Our purpose must be to obtain the blend of craft and thought which, on the one hand, delivers us from a creeping empiricism, and, on the other, from exorbitant ratiocinations. That for the progress and advantage of knowledge the polar activities of sense and thought should find a fair balance is eminent in great examples of mankind. Moreover, it is apprehended in the reciprocal tensions of faith and works, of hypothesis and experience, of science and craft. In our controversies on theory and practice, on universities and technical schools, on grammar and apprenticeship, we see their opposite stresses. The unison is far from being, as too often we suppose, one merely of wind and helm; it is one rather of wind and wing; it consists not in a mere obedience of hand to mind, but in some mutual implication or generative conjugation of them. How these two forms of impulse should live in each other we see in the fine arts—in the swift confederacy of hand and mind in Dürer and Michael Angelo, Rembrandt, Velasquez, Watteau, and Reynolds. The infinite delicacy of educated touch is almost more incredible than the compass of imagination. When they unite in mutual creation no shadow is too fleeting, no line too exquisite for their common engagement and mutual reinforcement. Michael Angelo and Leonardo da Vinci, the greatest craftsmen, perhaps, the world has seen, were as skilful to invent a water engine, to anatomize a plant, or to make a stone-cutter's saw, as to build the dome of St. Peter above the clouds of Christendom.

Solve the problem as hereafter we may, now we can take heed at least that energy shall not accumulate about one pole or the other. Our little children have a message to us if we would but hearken to them. Every moment they are translating action into thought and thought into action. Eye, ear, and hand are incessantly on the watch and in pursuit, gathering incessantly for the mind the forms of thought which as rapidly issue again in new activities. If, as we mature, we gain the power of restraint, it is not that we shall cease to act, that the mind shall depose the hand, but that these variables shall issue in a richer and richer function. If we forget the hand, that cunning loom which wove our minds; if we thrust our hands into our pockets, and turn our eyes inwards, will our minds still truly grow? That by virtue of the opposable thumb monkey became man is no metaphor; in its measure it is sober truth. For the last millennium too much thinking has been the bane of our profession; we have made it a point of honour to ignore the hands out of which we were fashioned, and in this false honour to forget that the end of life is action, and that only by action is action bred. While we are professing to admire Bernard Palissy or Jean Groujon, the mediaeval mason or the mediaeval goldsmith, we are still acting as if fine arts only are fine, and the mechanical arts base, whereby we blind ourselves to the common laws of growth which know not these distinctions, and bring barrenness on those who make them. We wean our children from the life of imaginative eyes and of thoughtful fingers; instead of teaching them to rise from simple crafts to practical crafts, to scientific crafts or to lovely crafts, and thus to pursue the mean of Nature herself, we teach them the insolence that, except in sport, the mind should drop the acquaintance of the fingers. Shall we wonder, then, that in this generation bold men call English people stupid, all stupid save those few men of genius or rich talent who, like Gilbert, Harvey, or Darwin, were great enough to be true to eye and to hand and to breed great conceptions by their intimate coition with the mind? Shall we wonder that medicine fell into sterility when by most unnatural bonds surgery, her scientific arm, was tied behind her and her sight was turned inwards from processes to formulas? Shall we wonder that even in the eighteenth century, when medicine had begun to occupy itself in the crafts of pathology and chemistry, one visionary after another, striding in long procession athwart the barren wilderness of physic, wasted his generation in squeamish evasion of the things that happen and in vain pursuit of vacuous unities? Yet if to the high stomachs of our forefathers surgical dabblings were common and unclean, there remained still some eyes curious enough and some fingers dexterous enough to carry the art back to the skill of Hippocrates, and forward to the skill of Lister, and by the mouths of barbers and cutters rather than of the pharisees of the colleges Medicine breathed her lowly message to her children.